

**AESHNA PERSEPHONE, A NEW SPECIES OF DRAGONFLY FROM
ARIZONA, WITH NOTES ON AESHNA ARIDA KENNEDY**
(ODONATA: AESCHNIDAE)

THOMAS W. DONNELLY, *Department of Geology, Rice University, Houston, Texas*

On 16 September, 1954, while on a collecting trip with George H. Beatty III, the author collected two males of an apparently undescribed species related to *Aeshna palmata* Hagen along Cave Creek, a vigorous and beautiful stream on the east side of the Chiricahua Mountains, Arizona. The identity of these dragonflies remained uncertain until an investigation of the type specimens of *Aeshna arida* Kennedy was undertaken in 1956. This investigation revealed that *Aeshna arida* was synonymous with *Aeshna palmata*, and that the Cave Creek specimens were of an undescribed species.

Prior to 1908 *Aeshna constricta* Say was the only species in the *Aeshna cyanea* complex recognized in North America. Walker (1908, pp. 379, 380) showed that three species had been included under the name *constricta*: *A. constricta* (a dominantly northeastern species), *A. palmata* Hagen (A Rocky Mountain and Cordilleran species originally described from Kamchatka), and a new species, *A. umbrosa* (a common trans-continental species). Subsequent to Walker's (1912) monograph two additional species were described, both by C. H. Kennedy from the southwestern United States: *A. walkeri* (Cordillera of central California to Baja California), and *A. arida* (New Mexico and Arizona) (Kennedy, 1918, p. 298). Kennedy had before him specimens of the species here described as new when he described *arida*; however, he selected as holotype of *arida* not the distinctive male specimen from Oak Creek Canyon, Arizona (Snow Collection, University of Kansas), but instead a male collected by himself at Fort Wingate, New Mexico. Thus the necessity of reducing Kennedy's species *arida* to synonymy with *palmata* stems solely from Kennedy's choice of holotype.

Aeshna persephone is most closely related to *A. palmata*, and appears to be confined to Arizona, whereas *palmata* has not been taken in that state. The name is suggested by the habitat of this large and colorful dragonfly. In contrast to the sunny streams and ponds favored by most of its North American congeners, it inhabits mountain streams which are lighted by the sun's rays for only a few hours each day, though it ascends periodically through the forest gloom to the sun-lit mountain slopes.

***Aeshna persephone*, new species**

Holotype male (Pl. I, fig. 1; Pl. II, figs. 7, 10).—Face pale greenish white, darkening slightly upwards. "T" spot black, distinct. Fronto-clypeal suture marked by a fine black line. Vertex black with a small yellow central spot. Occiput pale. Rear of head black.

Prothorax dark brown with a pale posterior lobe. Mesothorax and metathorax dark brown, with yellow markings, as follows: Dorsal thoracic stripes

well developed, brownish yellow, narrowed anteriorly. Anterior lateral stripe yellow, nearly 2 mm. broad, anterior border with a notch at $3/5$ of its height, narrowed above notch. Posterior border of anterior lateral stripe straight. Borders of stripe well defined. There is a small dorsal-posterior "tail" on this stripe. Posterior lateral stripe yellow, 2.5 mm. broad ventrally expanded to over 3 mm. broad dorsally, but with an indistinct posterior border. No pale markings on the mesepisternum. Legs dark brown. Wings hyaline, with one cell between A2 and A3 and an anal loop of 9-10 cells. Stigma dark brown. Costa dark on dorsal surface and pale brown on ventral surface.

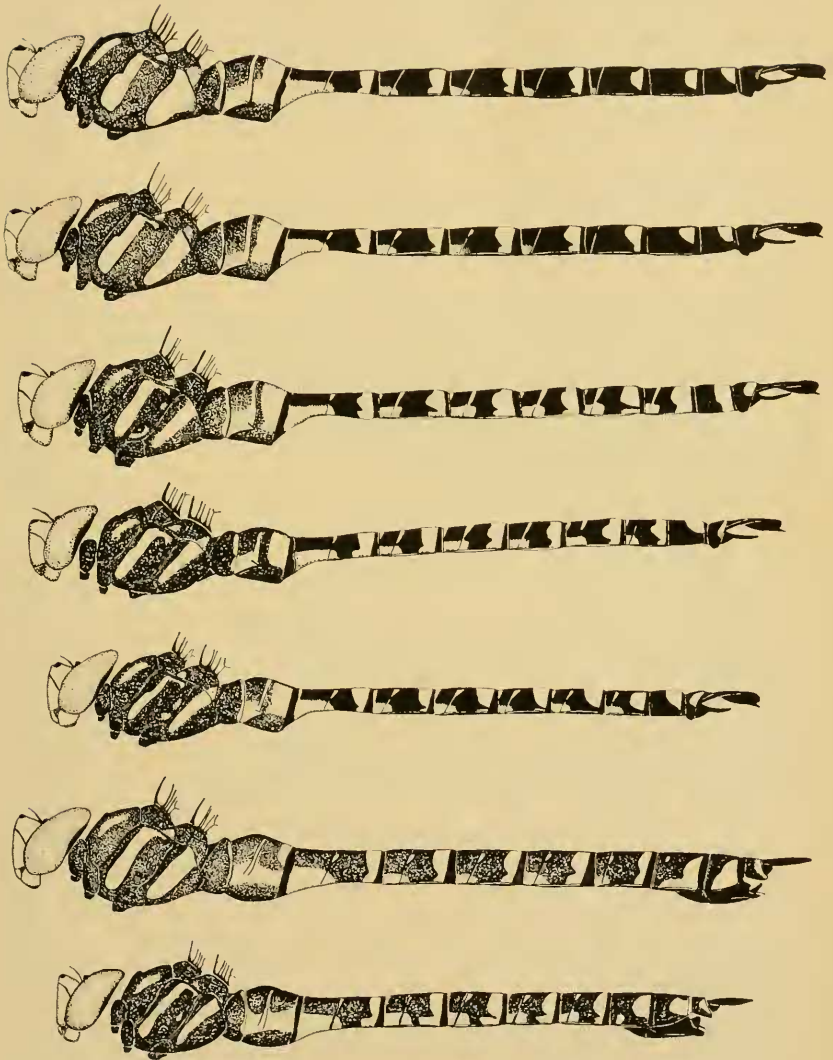
Abdomen very dark brown, blue markings as follows (System of designation of abdominal markings from Walker, 1912): On 1, PD and PL, narrowly joined laterally. On 2, MD (narrow) and AML (broad), joined laterally; PD and PL (both broad) joined laterally and dorsally; two small pale spots along ventral margin of tergum. On 3, AL very broad, ML distinct, PD and PL joined laterally but not dorsally. On 4-6, AL, PD, and PL present, diminishing in size rearward with PD and PL joined laterally. On 7, AL a tiny spot, PD rather broad, but not joined dorsally. On 8, PD smaller than on 7. On 9, PD joined dorsally. On 10, a small, diffuse PD. Anterior hamules similar to those of *A. palmata* (Pl. II, fig. 11), but with mesal-apical angle of the ventral portion of the hamule distinctly sharper than that of *Palmata*, and the apical notch of this portion of the hamule (immediately dorsal to the spine) wider than that of *palmata*. Terminal appendages black, the dorsal appendage broader than that of *palmata* (Pl. II, fig. 8).

Total length 77 mm., length of abdomen 57 mm., length of hind wing 51 mm., length of hind femur 8.5 mm.

Allotype female.—Head and thorax similar to that of male. Abdomen brown with yellow markings as follows: On 1, narrow PD and PL joined laterally. On 2, very broad AML, PL, and PD, all joined laterally. On 3, very broad AL; PD and PL joined laterally, but not dorsally. On 4-6, distinct AL, with PD and PL joined laterally, but not dorsally, and all spots diminishing in size rearward. On 7, a small PD-PL joined laterally. On 8 and 9, a larger PD and PL joined laterally, but not dorsally. On 10, a very small PD. Ovipositor similar to that of *A. palmata* (Pl. II, fig. 1,2), but with ventral-apical angle of genital valves sharper in outline and directed more to the rear than in *palmata*. Appendages 5 mm. long, with rounded apices, as in *palmata*. Styli about 1 mm. long. This specimen was reared, and had probably not attained the full color of the mature imago.

Length of abdomen 54 mm., hind wing 51 mm., length of hind femur 8 mm., length of terminal abdominal appendage 5 mm.

No noteworthy differences between any of the paratype males and the holotype male were found. There is some variation in the color of the pale lateral thoracic stripes towards green, but these colors are elusive and of no taxonomic usefulness. The paratype males vary in abdominal length from 54 to 59 mm. The paratype female is an incompletely developed reared specimen; it appears to be identical with the allotype female.



Color pattern of *Aeshna persephone*, *palmata*, and *constricta*, all natural size. Fig. 1, *A. persephone*, holotype ♂; fig. 2, *A. persephone* ♂, Oak Creek Canyon, Arizona; fig. 3, *A. palmata* ♂, City Creek Canyon, Utah (this is the largest male seen of this species); fig. 4, *A. palmata* ♂, Fort Wingate, New Mexico (holotype of *A. arida*); fig. 5, *A. palmata* ♂, Colorado Springs, Colorado; fig. 6, *A. persephone* ♀, Oak Creek Canyon, Arizona; fig. 7, *A. palmata* ♀, vic. of Baggs Wyoming.

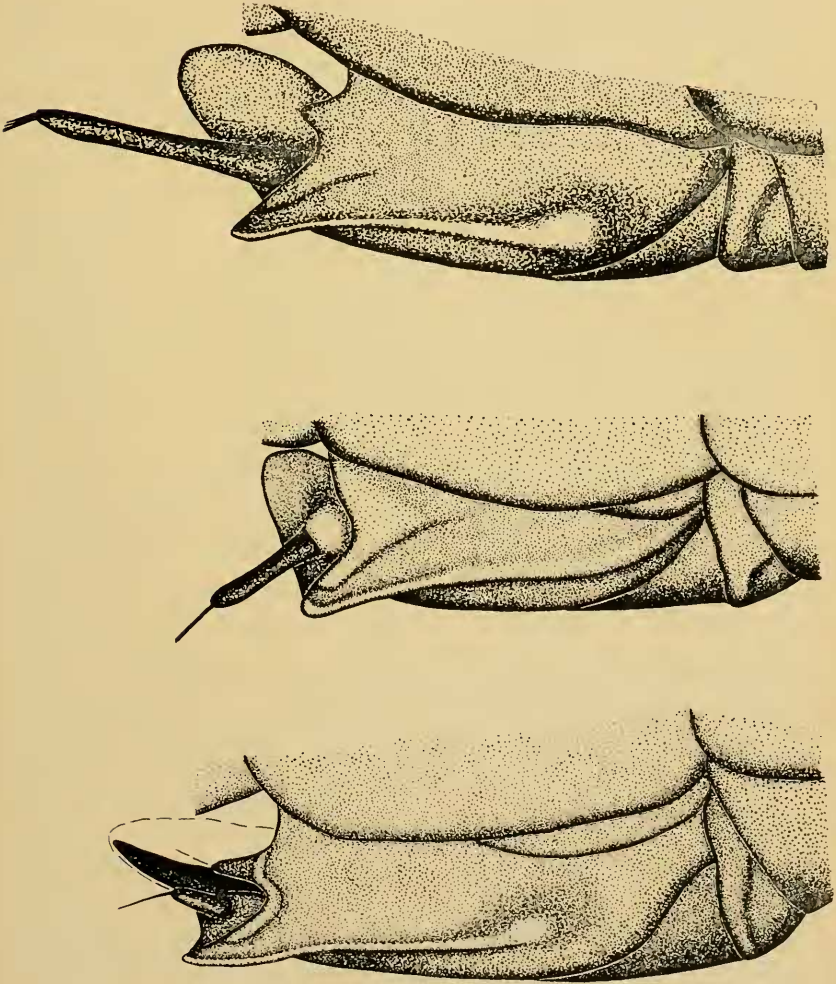
The Oak Creek Canyon male (described also by Kennedy as a paratype of *A. arida*) and female differ slightly from the Cave Creek series. The male (Pl. I, fig. 2) has the abdominal length 58 mm. and the hind wing length 52 mm., the thoracic stripes narrower (the anterior lateral is just over 1.5 mm. and the posterior lateral is 1.75 mm. wide). The abdomen has a tiny MD on 4 to 6 and a tiny PL on 7 joined to PD. The female (Pl. I, fig. 7) has narrower anterior lateral pale thoracic stripes (1.75 mm.), a larger PL on 8 and 9, a diffuse ML on 9 joined to PL, and a tiny MD on 3 to 7. The female appendages (Pl. II, fig. 4) are 6 mm. long, pointed apically, and markedly asymmetrical in dorsal view, with a nearly straight lateral margin.

Material examined.—*Aeshna persephone*, n. sp., 10 ♂♂, 3 ♀♀. Holotype ♂: Herb Martyr Dam, on Cave Creek, near Portal, Cochise Co., Arizona, 16 September 1954, collected by T. Donnelly. Allotype ♀: reared by Minter Westfall from the Southwest Research Station five miles west of Portal, emerged September, 1958. Paratypes: 8 ♂♂, 1 ♀: One ♂ has the same data as the holotype, 2 ♂♂ and 1 ♀ were reared in 1956 and 1958 by Minter Westfall from Cave Creek. Other specimens examined: 1 ♂ and 1 ♀: Oak Creek Canyon, Arizona, elevation 6000 feet, August (no year), collected by F. H. Snow. The latter two specimens were rather badly damaged in transit back to the University of Kansas collection. The holotype ♂, allotype ♀, and all but two of the paratypes are in the collection of the University of Florida. The remaining two paratype males are in the collections of George H. Beatty III and the author.

***Aeshna palmata* Hagen**, 87 ♂♂, 13 ♀♀: The majority of the specimens examined (54 ♂♂, 9 ♀♀) were collected by the author in the vicinity of Baggs, Carbon Co., Wyoming, during the summer of 1955. Another large lot of specimens (23 ♂♂, 3 ♀♀) were collected by Minter Westfall in Gunnison Co., Colorado, in 1959. The remaining specimens are as follows: 3 ♂♂, 1 ♀: Fort Wingate, New Mexico, 5 September, 1908, collected by C. H. Kennedy, Academy of Natural Sciences, Philadelphia. This lot includes the holotype and cotype males of *A. arida* (The existence of more than one specimen of *Aeshna* from Fort Wingate was not mentioned by Kennedy. 1 ♂: Colorado Springs, Colorado, August (no year), collected by E. S. Tucker, University of Kansas collection. 1 ♂: City Creek Canyon, Salt Lake Co., Utah, 5 July 1899, Academy of Natural Sciences, Philadelphia. 1 ♂: Denver, Colorado, no date, collected by C. C. Adams, Academy of Natural Sciences, Philadelphia. 3 ♂♂: Klamath Lake, Oregon, 1 August, 1954, collected by R. H. Gibbs, 1 ♂: Donnelly and Biek collections. Franklin, Idaho, 1 October, 1949, collected by R. P. Parkinson, G. H. Biek collection.

Several *Aeshna constricta* from the central and western United States were examined. Of these, one male from Minnesota and two males from Nebraska appeared to be very close to typical northeastern specimens. An additional male, labeled *Aeshna constricta*, was collected along the Humboldt River, near Golconda, Nevada, on 8 Au-

gust, 1914, by C. H. Kennedy. This specimen differs in several respects from the typical eastern *constricta*: the thoracic pale stripes are narrow and resemble those of *palmata*, and the abdominal markings are slightly different from the typical *constricta*. Kennedy (1917, p. 622) mentions the capture of several females of this species at



Figs. 1-3, ovipositor. Fig. 1, *A. persephone*, Oak Creek Canyon, Arizona (identical to that of the allotype); fig. 2, *A. palmata*, Baggs, Wyoming; fig. 3, *A. constricta*, Manchester, Maine.

Golconda on the preceding day and the following day, but he mentions no males. Possibly his failure to mention this male indicates that he recognizes the peculiarities of this male and intended to study the problem further. The problem of Nevada *constricta* appears to be quite distinct from *palmata-persephone* problem, but inasmuch as *constricta* is the next most closely related species to *palmata* and *persephone*, further study of *constricta* from the Great Basin should be undertaken.

VARIATION OF AESHNA PALMATATA AND THE PROBLEM OF AESHNA ARIBA

A long series of *Aeshna palmata* from southern Wyoming showed relatively little variation. The average abdominal length is 51.5 mm. (varying from 49 to 55 mm.), the average hind wing length is 43.5 mm. (varying from 41 to 46 mm.), and the average widths of the anterior and posterior lateral thoracic stripes are both 1 mm. (varying from .75 to 1.5 mm.). Abdominal spot PL persists rearward to segment 6 and is joined to PD rearward to 3 or 4 in most specimens. MD and the pair AL-ML are prominent and reach segment 8 in all specimens. The western Colorado specimens have the abdominal length 52.5 mm. and the posterior lateral thoracic stripes about 1.25 mm. wide on the average; otherwise, these specimens are identical to those from Wyoming. Two more southern specimens of *palmata*, from Colorado Springs and Fort Wingate, New Mexico (not *arida*), and the Oregon and Idaho males are likewise nearly identical to the Wyoming specimens.

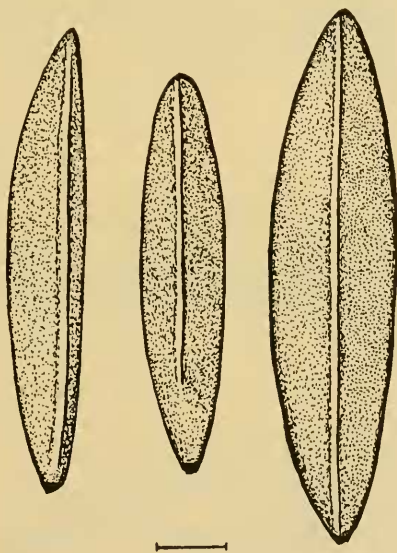
Four specimens, including the holotype (Pl. I, fig. 4) and cotype of *A. arida*, are slightly larger and paler than the typical northern *palmata*. These vary in length of abdomen from 53 to 57 mm., and the dark line on the fronto-clypeal suture is narrow, except for the Denver specimen. The thoracic stripes are slightly broader (The anterior lateral stripe is 1.3 to 1.5 mm. wide; the posterior lateral stripe is about 1.5 mm. wide), and the abdomen has more extensive pale markings than do the Wyoming *palmata*. The PL of the holotype of *arida* reaches segment 8 and is joined to PD on 8 and 9. The PL of the City Creek Canyon specimen (Pl. I, fig. 3) reaches 9 and is joined to PD on 2 to 8. The Wyoming specimens have PL on 2 to 6 joined to PD rearward to 3 or 4. Thus there is a tendency for southern specimens of *palmata* to be larger and paler than more northern or higher elevation specimens. The absence of distinguishing structural characteristics and the variability in size and color marking at the type locality of *arida*, however, both suggest that *arida* is not a valid species.

Southern specimens of *Aeshna palmata* are similar to *persephone* in only two respects: overall size and breadth of thoracic stripes, although *persephone* distinctly exceeds *palmata* in both these characters. Southern *palmata* show no tendency towards the restriction of pale markings that is so marked in *persephone*. Further, no specimens of *palmata* show the form of the anterior hamule found in

persephone, although this structure is frequently distorted during drying and is not always easy to observe. Only one southern *palmata* female was examined, but this had the typical *palmata* ovipositor.

DIAGNOSIS OF AESHNA PERSEPHONE

The most distinctive character of this species is its size and robustness, which greatly exceed all but one *Aeshna palmata* specimen examined. *Persephone* has much broader thoracic stripes than either *palmata* or *constricta*. *Persephone* lacks the distinctive lateral abdominal spots PL and ML on 6 to 8, and has AD greatly reduced on 4 to 5. *Palmata* and *constricta*, on the other hand, have these spots



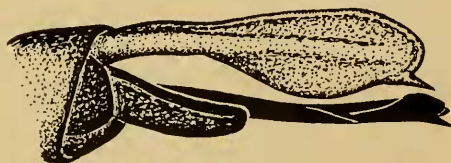
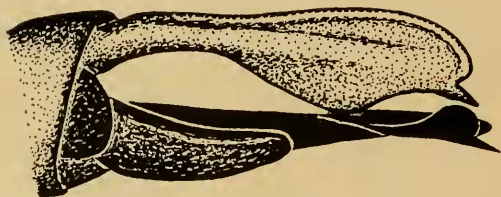
Figs. 4-6, terminal appendage of female, viewed ventrally, oriented apically upwards. Fig. 4, *A. persephone*, Oak Creek Canyon, Arizona; fig. 5, *A. palmata*, Baggs, Wyoming (the allotype of *A. persephone* is very similar to this); fig. 6, *A. constricta*, Manchester, Maine.

well developed on 4 to 8. The fronto-clypeal suture of *persephone* has a fine black line, as in some southern *palmata*, whereas northern *palmata* have a heavy black line on this suture and *constricta* has a fine brown line. The female of *persephone* resembles *palmata* in color markings but has the broad thoracic stripes of the male *persephone*.

Structurally, *persephone* differs in several ways from *palmata* and *constricta*. The ventral aspect of the anterior hamule (Pl. II, figs. 10-12) shows some important differences: the ventral-mesal angle of the ventral portion of this hamule is more angular in *persephone* than in either *palmata* or *constricta*. The apical notch of this portion

of the anterior hamule is narrowest in *constricta*, less so in *palmata*, and broadest in *persephone*. The terminal abdominal appendage (Pl. II, figs. 7-9) is broadest in *persephone*, less so in *palmata*, and narrowest in *constricta*.

The female ovipositor (Pl. II, figs. 1-3) is distinctive in each of these species. The stylus is about 1 mm. long in *persephone* and

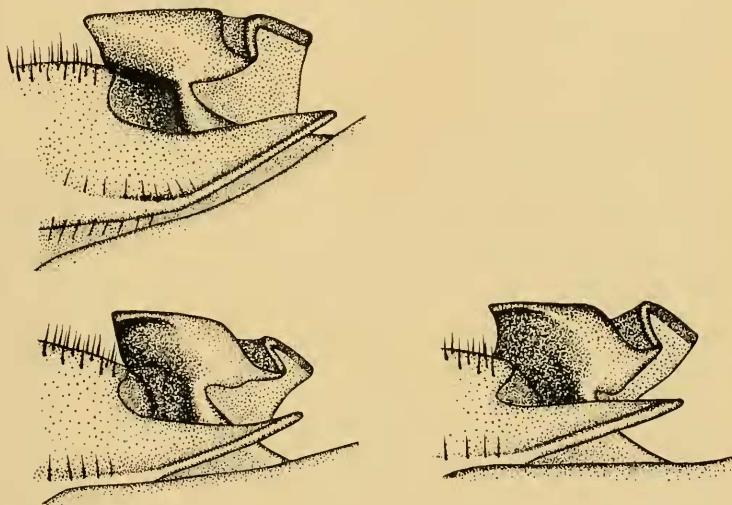


Figs. 7-9, terminal appendage of male, viewed latero-ventrally. Fig. 7, *A. persephone*, holotype; fig. 8, *A. palmata*, Baggs, Wyoming; fig. 9, *A. constricta*, St. Lawrence Co., New York.

palmata and about 2 mm. long in *constricta*. The terminal appendage of the female (Pl. II, figs. 4-6) is long and broad in *constricta* and narrower and shorter in the other two species. The allotype female of *persephone* has an appendage which is very similar to that of *palmata*, but the Oak Creek Canyon female of *persephone* has curiously asymmetrical appendages, with the outer edges nearly straight.

CONCLUSIONS

Aeshna persephone, which is known only from two widely separated localities, is specifically distinct from *palmata* and *constricta*, neither of which has been taken in Arizona, but which occur in adjoining states. *A. arida* is not specifically distinct from *palmata*, but represents only a variant of that species occurring at lower elevations. Further study might well show that *arida* is a recognizable subspecies of *palmata*.



Figs 10-12, anterior hamule of male, viewed ventrally, oriented apically upwards. Fig 10, *A. persephone*, holotype; fig. 11, *A. palmata*, Baggs, Wyoming; fig. 12, *A. constricta*, Ithaca, New York. The bar is 1 mm. long for each group of figures.

There is clearly much to be learned about the dragonflies of this group in the American Southwest. Confined as they are to rushing mountain streams in a dominantly desert region, they may be found to show many degrees of infraspecific differentiation through isolation. The author hopes that this note will encourage further collecting of *Aeshna* in this area with the aim of a better appreciation of the relationships among the insects of this group.

ACKNOWLEDGEMENTS

Specimens of this new species were collected during a trip made jointly by the author and George H. Beatty, III, who loaned one of the paratype males from the collection of G. H. and A. F. Beatty. Beatty studied this specimen and expressed the view that it repre-

sented an undescribed species, and Edmund M. Walker studied the same specimen and corroborated Beatty's opinion. Beatty has read the MS of this paper critically and has made many useful suggestions. Dr. Walker also read a preliminary draft of this paper and suggested several improvements. Harold Grant of the Academy of Natural Sciences, Philadelphia, and Ashley Gurney of the United States National Museum made specimens in these collections available to the author. Charles D. Michener loaned the Oak Creek Canyon specimens from the University of Kansas collection. Minter Westfall loaned several specimens of the new species, and he has read the MS of this paper. George Bick loaned several specimens of *Aeshna* from his collection. The author is greatly indebted to all of the above for their assistance.

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KEYS TO SUBFAMILIES, TRIBES, GENERA AND SUBGENERA OF THE GERRIDAE OF THE WORLD by H. B. Hungerford and R. Matsuda, Univ. Kansas Sci. Bull., vol. 41(1), pp. 3-23, figs. 1-64. and **MORPHOLOGY, EVOLUTION AND A CLASSIFICATION OF THE GERRIDAE (HEMIPTERA-HETEROPTERA)**, *loc. cit.* vol. 41 (2), pp. 25-632, figs. 65-1151.

These important contributions are not as separate as the titles would imply, the figure numbers being consecutive and references in one may apply to the other.

Verbal, pictorial and statistical treatment of descriptive, developmental and comparative external anatomy is full and leads to selection of phylogenetic characters not conventionally used; the resulting suprageneric categories, including the family, have limits differing from those previously applied. The "List Indicating Primitive and Specialized Alternatives for Certain Characters" should be a challenge for other authors to present their ideas on such important matters in as concise a form.

The abundant illustrations are of the clear, helpful type expected from Dr. Matsuda.—RICHARD C. FROESCHNER, *Entomology Research Division, ARS, U. S. Department of Agriculture, Washington, D. C.*